

Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 4 –
EXAMINATION – SUMMER 2026

Subject Code: BE04000221

Date: 21/05/2026

Subject Name: Operating System

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions:

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks.**
- 4. Simple and non-programmable scientific calculators are allowed.**

- Q.1**
- | | | |
|------------|--|-----------|
| (a) | Explain the role of kernel in an operating system. | 03 |
| (b) | Discuss the goals and functions of Operating Systems. | 04 |
| (c) | Explain various types of Operating Systems with suitable examples. | 07 |

- Q.2**
- | | | |
|------------|---|-----------|
| (a) | Compare: user-level threads and kernel-level threads. | 03 |
| (b) | Explain how aging prevents starvation in priority scheduling. | 04 |
| (c) | Consider the following processes: | 07 |

Process	Arrival Time	Burst Time
P1	0	8
P2	1	4
P3	2	9
P4	3	5

Methods to be performed are FCFS and SRTF.
Do the following:

- Draw Gantt chart
- Find Average Waiting Time
- Find Average Turnaround Time

OR

Q.2 (c) What is PCB? Explain the complete life cycle of a process in an operating system with suitable diagram. **07**

Q.3 (a) Define Semaphore and explain binary semaphore. **03**

(b) How Peterson's Solution solve critical section problem? **04**

(c) A system has four processes (P0, P1, P2,) and (P3) and three resource types (A, B and C). The total number of instances of resources (A, B,) and (C) are 12, 8, and 10 respectively.

The current Allocation and Maximum matrices are given below:

Process	Allocation (A B C)	Max (A B C)
P0	2 3 3	7 6 5
P1	4 2 2	6 5 4
P2	3 1 4	8 4 6
P3	1 2 1	5 3 3

Available Resources:(2, 0, 0)

Answer the following:

- Calculate the Need Matrix for all processes.
- Determine whether the current system is in a safe state using Banker's Algorithm. If the system is safe, write one safe sequence.
- If process (P2) requests resources ((2, 0, 1)), determine whether the request can be granted immediately. Show all necessary steps and justification.

OR

Q.3 (a) Define Deadlock and list its necessary conditions. **03**

(b) The following two functions P1 and P2 that share a variable B with initial value of 4 execute concurrently. **04**

P1()	P2()
{	{
C=B-1;	D= 2*B;
B=2*C;	B=D-1;
}	}

Provide the number of distinct values that B can possibly take after the executions of two functions.

(c) Explain Dining Philosopher problem and provide possible deadlock situations. **07**

Q.4 (a) Differentiate: Internal Fragmentation and External Fragmentation. **03**

(b) What is thrashing? Explain its effect on CPU Utilization. What should be the solution of it? **04**

- (c) A system uses virtual memory with 3 page frames: 07
3,2,1,0,3,2,4,3,2,1,0,4

provide details on page faults for FIFO,LRU and OPTIMAL algorithms.

OR

- Q.4**
- (a) What is paging? How it is different from Segmentation? 03
- (b) What is Translation Lookaside Buffer? Provide its advantages and disadvantages. 04
- (c) A logical address space of 8 MB is mapped to a physical memory of 256 KB using paging. The page size is 4 KB. 07
a) Calculate the number of bits required for logical address, physical address, page number, and page offset.
b) How many pages are there in the logical address space?
c) How many frames are there in the physical memory?
d) If the page table entry size is 4 bytes, what is the size of the page table?

- Q.5**
- (a) What is RAID? State its advantages. 03
- (b) Explain VMware ESXi and Microsoft Hyper-V. 04
- (c) Consider a disk with tracks numbered from 0 to 199. 07
The request queue is: 23, 89, 132, 42, 187, 65, 14, 170
Initial head position = 100
Head movement direction = towards lower track numbers.
Solve using FCFS, SSTF, SCAN, and C-SCAN disk scheduling algorithms.

OR

- Q.5**
- (a) Differentiate: Virtual Machine and Physical Machine. 03
- (b) Explain following Linux commands: 04
1. grep
2. ls
3. touch
4. sort
- (c) Write a shell script to create a file containing student details such as Full Name, Enrollment Number, Branch, and Semester. The script should also: 07
- Display the total number of lines in the file
 - Display the total number of characters in the file
 - Search and display the full student record based on a given string input.
